Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.

Name and section: ____________________

Instructors name: ____________________

1. Evaluate these the differentials

(a) [1]

$$\frac{d}{dx}\left(A\cos\left(3x^2\right)\right)$$

(b) [2]

$$\frac{d}{dx}\left(x^2\cos\left(3x^2\right)\right)$$

(c) [3]

$$\frac{d}{dx}\left(A(x)^{-1}\cos\left(3x^2\right)\right)$$
$$A(x) = x^2 - x$$

(d) [3]

$$\psi(x)\frac{1}{2m}\frac{d^2}{dx^2}\left(\psi(x)\right)$$
$$\psi(x) = \mathrm{e}^{-\frac{x}{2}}$$

(e) [2]

$$\frac{d^2}{dx^2}\left(\frac{3x^2}{\ln\left(x^3\right)}\right)$$

(f) [4]

$$\frac{d^2}{dxdy}\left(3x^2\sin\left(\frac{x}{x+1}+y^2\right)\right)$$

2. Hows does Gibbs energy relate to reaction driving force? [1]

3. What factors can make a reaction unfavourable? [1]

4. The rate of a reaction is not constant in time but depends upon other factor. What are these factors? [1]

5. How would the following reactions be classified? [3]

(a) $A \longrightarrow P$

(b) $A + B \longrightarrow C$, $C + C \longrightarrow D$

(c) $A + B \longrightarrow D$, $D \longrightarrow A + B$

(d) $A + A \longrightarrow P$

(e) $A \longrightarrow C + D$, $A + B \longrightarrow E$

6. Describe collision theory? What factor are important to consider how likely a reaction is [2]

7. How can this reaction be expressed as a rate law? (Write the expression) [2]

$$A + B \longrightarrow P$$

8. What is the order of the previous questions reaction? [1]

9. How can this reaction be expressed as a rate law? (Write the expression) [2]

$$A + B + C \longrightarrow P$$

10. How do the Van't Hoff and Initial rate methods differ? [2]

11. Derive the rate law using integration from the rate [3]

$$-\frac{d[CO_2]}{dt} = k[CO_2]$$

12. Derive the rate law using integration from the rate [3]

$$-\frac{d[CO_2]}{dt} = k[CO_2]^3$$

13. How can multiple reagents be treated to find the rate of the reaction? [2]

14. How does the pseudo rate constant used in dealing with multiple reagaents differ from the standard definition? [2]

15. Under what conditions should steady state be used and what conditions should pre-equlibrium be used? [2]

16. Given that at 25° the rate is 0.2 and that at 40° the rate is 1.2. Assuming it is elementary what is the activation energy? [4]

$$k = A\mathrm{e}^{-\frac{E_{ac}}{RT}}$$